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(54) Title of Invention: LASER REPAIR DEVICE FOR SEMICONDUCTOR INTEGRATED CIRCUIT

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(72) Inventor: Hiroshi Nishimura c/o NEC Kyushu Limited  
(71) Applicant: NEC Kyushu Limited 100 Yahata-cho, Kumamoto-shi, Kumamoto-ken  
(74) Agent: Ataru Sugano

### Specification

#### 1. Title

LASER REPAIR DEVICE FOR SEMICONDUCTOR INTEGRATED CIRCUIT

#### 2. Claim

A laser repair device for cutting an IC fuse placed on a wafer by irradiating it with laser beams based on the data of fuse-cutting information collected by an electrical property testing device characterized in comprising:

an optical system that splits a laser beam emitted by an optical source into a plurality of beams and irradiates a plurality of IC fuses placed on said wafer with said plurality of laser beams simultaneously;

a shutter unit that is provided for each of said optical systems and opens/closes the light path; and

a controller that controls the opening and closing of each of said shutter units based on the fuse cut information data.

#### 3. Detailed description of the invention

(Industrial field of application)

The present invention relates to a laser repair device for a semiconductor integrated circuit that executes IC fuse-cutting based on the fuse-cutting information collected by an IC

electrical property testing device using a redundancy circuit in the electrical property test of IC chips in the wafer status.

(Prior art)

The prior art laser repair device executes the fuse-cutting process by irradiating a single IC fuse with a laser beam based on the fuse-cutting information collected by an IC tester.

[Problem to be solved by the invention]

The abovementioned prior art laser repair device, which executes the fuse-cutting process by irradiating a single IC fuse with a laser beam based on the fuse-cutting information collected by an IC tester, had a shortcoming of an increased cost per each IC chip due to the higher equipment cost and the insufficient processing capability as a result of the trend in the industry in recent years of the higher degree of integration which result in an increase of the number of IC chips using redundancy circuits, the higher yield required, and the increase of the number of fuses on the circuit.

The object of the present invention is to provide a laser repair device that can solve the abovementioned shortcoming.

{Differences of the present invention with reference to the prior art}

While the abovementioned prior art laser repair device executes the fuse cutting process on a single IC chip, the present invention is different from it in that it executes the fuse cutting processes on a plurality of IC chips simultaneously.

(Means of solving the problem)

In order to achieve said object, the present invention provides a laser repair device for cutting an IC fuse placed on a wafer by irradiating it with laser beams based on the data of fuse-cutting information collected by an electrical property testing device characterized in comprising: an optical system that splits a laser beam emitted by an optical source into a plurality of beams and irradiates a plurality of IC fuses placed on said wafer with said plurality of laser beams simultaneously; a shutter unit that is provided for each of said optical systems and opens/closes the light path; and a controller that controls the opening and closing of each of said shutter units based on the fuse cut information data.

(Embodiments)

Next, the present invention will be described in detail with reference to the accompanying drawings.

(Embodiment 1)

Fig. 1 is a schematic drawing of the first embodiment of the present invention, and Fig. 2 is a vertical cross-section of a part-A of Fig. 1.

The drawing shows that the present invention comprises optical systems that irradiate a plurality of IC fuses on a wafer simultaneously with the laser light emitted by a YAG laser oscillator 5, which is split into multiple beams; shutter units 2 and 3 that open or close the light path in each optical system; and controllers 19 and 20 that control the openings and closings of the shutter units 2 and 3. Said optical system consists of a YAG laser oscillator 5, SHG 6, attenuators 9 and 10, a beam expander 11, a half reflection mirror 14, and a full reflection 15. It also comprises an ITV 4; a joule meter 7, light guides 8 and 12, and an aperture 13.

In the embodiment, the laser beam emitted by the YAG laser oscillator 5 is rectified by the SHG 6, adjusted to a proper energy by means of the attenuators 9 and 10, expanded vertically by the beam expander 11, and focused to a proper size by the aperture 13. The laser beam, after being reflected by the half reflection mirror 14, passes through the shutter unit 2, and is directed to an IC fuse on the wafer 1.

In the meanwhile, the laser beam that passes through said half reflection mirror 14 is reflected by the full reflection mirror 15, passes through the objective lens and the shutter 18 of the shutter unit 3, and is directed on a different IC fuse on the wafer 1. The shutters 17 and 18 open or close based on the information supplied by the controllers 19 and 20 that control whether to irradiate the fuses or not. The joule meter 7 measures the laser beam's energy.

The condition of the wafer 1 is displayed on the monitor by the ITV 4. The light guides 8 and 12 provide illumination for it.

While it was shown a case of irradiating multiple IC fuses simultaneously by splitting the light pass into two systems in the above embodiment, it is also possible to execute further more fuse cutting operations simultaneously by providing more sets of reflection mirrors, shutter units and controllers.

(Embodiment 2)

Fig. 3 shows a vertical cross section showing the second embodiment of the present invention.

The figure shows that this embodiment comprises full reflection mirrors 18a and 18b beneath shutter units 2 and 3. The reflection mirror 18a modulates the light paths of the beams having passed through the shutter units 2 and 3 in a vertical angle, and the full reflection mirror 18b irradiates the laser beam reflected by the full reflection mirror 18a to an arbitrary position on the wafer 1. Since the two laser beams can be arbitrarily spaced by moving said full reflection mirror 18b, this embodiment has an advantage of irradiating IC chips with small sizes.

(Effect of the invention)

As can be seen from the above description, the present invention is effective in increasing the processing efficiency of the device by simultaneously irradiating a plurality of IC fuses with the laser beams based on the fuse cut information collected by the IC tester.

4. Brief description of the drawings

Fig. 1 is a schematic drawing of the first embodiment of the present invention, Fig. 2 is a vertical cross-section of a part-A of Fig. 1, and Fig. 3 is a vertical cross section of the essential parts showing the second embodiment of the present invention.

- 1 Wafer
- 2, 3 Shutter units
- 4 ITV
- 5 YAG laser oscillator
- 6 SHG
- 7 Joule meter
- 8 Light guide
- 9 Attenuator
- 10 Attenuator
- 11 Beam expander
- 12 Light guide
- 13 Aperture
- 14 Half reflection mirror
- 15 Full reflection mirror
- 16, 17 Shutters
- 18a, 18b Full reflection mirrors
- 19, 20 Controllers

Patent applicant: NEC Kyushu Ltd.

Agent: Ataru Sugano

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